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ABSTRACT

This guide provides information on seizures in students with traumatic brain injury (TBI) and offers guidelines for classroom management. First, a classification system for seizures is presented with specific types of seizures explained. Post-traumatic seizures are specifically addressed as is the importance of seizure prevention when possible. Cognitive consequences of seizures, including the fragmenting of information organization in memory and processing impairments, are addressed. Important information for educators covers behavioral symptoms, a recommended documentation protocol, toxic effects of antiseizure drugs, and recognizing a medical emergency. Teaching implications are considered, and suggestions (e.g., permitting the child to be aware of his/her fears) are offered. Finally, recommendations for teaching students with late-onset post-traumatic epilepsy are offered. (DB)

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SEIZURES FOLLOWING TRAUMATIC BRAIN INJURY IN CHILDHOOD

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Seizures (the physical manifestation of epilepsy) are sudden bursts of abnormal electrical activity of brain cells. Such activity may be caused by chemical imbalance resulting from acute trauma, physical or chemical irritants associated with swelling of brain tissue, or by abnormal function of groups of brain cells. Abnormal firing of brain cells may result from permanent scarring of tissue long after physical healing has taken place. Seizures may also occur after any event which puts physical stress on the brain or which creates electrochemical imbalance (poisoning, high fever, acute metabolic disorders, extreme fatigue), particularly when systems are delicate (as in infancy) or when seizure thresholds are inherently low. Certain chronic medical conditions (cerebral palsy) or progressive diseases (tumors, meningitis/encephalitis) may also be associated with seizure activity.

Classification

Seizures are classified by their relative involvement of brain mass. **Partial seizures** are usually local in nature and may have motor, sensory, or emotional symptoms. **Generalized seizures** reflect involvement of both brain hemispheres, or global abnormal electrical activity. Behavioral manifestations also aid in the classification of seizures. **Simple seizures** are those which do not show impairment of consciousness. **Complex seizures**, however, are accompanied by loss of consciousness or by loss of awareness of surroundings. Behaviors also include motor manifestations: stiffening, jerking, or sudden slackening of muscles; deviation of the eyes; repeated, sometimes complicated movement patterns which appear purposeless and which may mark the child as strange (rubbing of body parts, action patterns or routines which are inappropriate to the situation, such as face washing, or relatively elaborate connected sequences which are made up of recognizable bits and pieces of daily activities and may resemble ritual behavior).

The wide variety of behavioral manifestations and underlying complexity of electrical and chemical activities of the brain make descriptive classifications numerous and complicated. For this

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reason, most nonspecialists use three classifications when describing seizures: absence (petite mal), grand mal, and psychomotor (temporal lobe) seizures.

Absence or **petite mal seizures** are marked by sudden onset, interruption of ongoing activities, blank stare, and brief upward movement of the eyes. The absence may last from a few seconds to half a minute. During this period, the child will usually not respond when spoken to. Attacks may be so brief that they go unnoticed in the busyness of the classroom, particularly in a mainstream setting where activities normally start and stop periodically. Absence attacks may vary in frequency from a few to hundreds during the course of the day.

Grand mal seizures are often marked by dramatic motor symptoms. Falling, stiffening, or jerking of the arms and legs are common manifestations of the grand mal seizure. Motor manifestations may be accompanied by loss of bladder control (incontinence), frothy salivation, and crying out. Loss of consciousness is commonly seen during the grand mal seizure and consciousness may return gradually or the child may lapse into sleep. These behaviors add to the frightening nature of the seizure episode.

Temporal lobe seizures, also known as **psychomotor seizures**, may be associated with sudden emotional changes, bizarre behavior patterns, or hallucinations. The child may complain of bad tastes and smells, become fearful, tearful, or angry, and may display repeated robotic actions or ritual-like behaviors. For example, he or she may pick up objects from the desk and throw them on the floor one by one, then continue the routine even after there are no objects left to throw. Or, he or she may begin a monotonous chanting of words which cannot be interrupted. Behaviors are sometimes so complicated and strange that psychopathology is suspected. Or the acts may look purposeful, as if intended to interrupt and disturb others.

Post Traumatic Seizures

Seizures which immediately follow traumatic injury (early onset) are more common in younger children and in those who have had severe brain trauma. These show up in obvious ways such as lapses of consciousness, and shaking, jerking, or twitching of body parts. Late onset seizures (seizures after the first week following injury) are less frequent consequences of traumatic brain injury than are early onset seizures. Late onset seizures may show up at any time from a week to years after the injury occurs, but there is evidence that the risk of seizures decreases as time passes. That is, the risk is greatest within the first 12 months and successively declines with each passing year.

The increased risk during the first year post injury has led to the medical practice of prescribing anticonvulsant medication routinely in an effort to prevent seizures. Although this practice is still somewhat controversial, follow-up studies have shown significant reduction of early onset seizures in individuals who have been given anticonvulsants within hours after the injury occurs. Reduction of late onset seizures has not been so clear cut.

Seizure Prevention

There are a number of reasons that physicians might want to avoid seizures in children. Among these are prevention of further brain damage which has been associated with some kinds of seizure disorders, as well as the prevention of unrelenting seizure activity (status epilepticus) which can result in severe cardiac or respiratory disturbances or arrest and further brain injury caused by interruption of oxygen (hypoxia or anoxia). In addition, seizures put children at greater risk for secondary injury from falls and bodily trauma resulting from banging against objects during convulsive episodes. There are also psychosocial consequences associated with threat of loss of control, frightening manifestations, and the fear and embarrassment of having a seizure in a public/social setting.

Seizures and Cognition

Cognitive consequences of seizures seem to be of two kinds: (1) electrochemical disruptions which interfere with the acquisition of information by fragmenting logical information structures and relationships and which may devastate the organization of information in memory storage; and (2) processing impairments which result from system compromise associated with medical treatment (drug management or surgical interventions).

Evidence for processing disturbances associated with electrochemical disruptions has been found in studies of children with absence seizures where information processing was disrupted both during the brief seizure period and between absence episodes. Evidence for significant impact on established memory has been seen in studies of adults who have received electroconvulsive shock therapy for severe depression.

All medications for seizure control have potential to impair attention, memory, and information processing speed and efficiency. Commonly used drugs include phenobarbital, Dilantin, Tegretol, and valproic acid (Depakote).

In some cases, anticonvulsant drug treatments do not result in acceptable control of seizure activity. In this event, surgical

interventions may be attempted. Surgical treatments for seizure control usually involve removal of abnormally functioning brain tissue. In more radical procedures, surgical severing of the band of nerve fibers which connect the two cerebral hemispheres is done (resection or partial resection of the corpus callosum). While these techniques are often successful at controlling disabling seizure activity, removal of brain tissue sometimes takes its own toll in terms of learning and memory deficits. In addition, surgical treatments are by nature the most invasive of measures and it is virtually impossible to perform surgery on an organ as delicate as the brain without additional damage to healthy brain tissue.

Successful management of seizures, either by means of drugs or by means of surgery is measured by reduction of or disappearance of the clinical symptoms of seizures. This generally means that outward behavioral manifestations are no longer seen. However, even when the clinical symptoms are controlled, some children show abnormal EEG patterns indicative of subclinical electrophysiologic events which may interfere with the subtle and complex processes necessary to learning.

What Educators Need to Know

Educators need to be aware that seizures may occur in children who have sustained traumatic brain injury. The seizure risks are greatest in those children who have sustained severe head injury with acute intracranial bleeding requiring surgical removal of blood clots. Risks are increased if the child had early onset seizures. According to Jennet (1990), as many as one third of the children with this combination of post traumatic complications may have late onset seizures. As a whole population, regardless of the degree of severity, two to three children out of every one hundred injured may be expected to have late onset seizures. This number doubles if the child was injured badly enough to have been hospitalized.

Behavioral Symptoms

All who work directly with the child should be sensitive to the more subtle symptoms of seizure activity:

Abrupt interruption of activities
Starring
Slackening of posture or facial muscles
Loss of saliva management (drooling)
Deviation of the eyes or eyelid fluttering
Urinary or fecal incontinence
Repetitive or ritual-like activity

Sudden changes in the level of alertness
Confusion which seems sudden and episodic
Sudden unexplained fears of persons or surroundings

These symptoms should be reported to the school nurse, parents, and the child's primary physician as soon as possible after they are noted. Symptoms should also be documented each time they occur.

The following documentation protocol is suggested:

Complete description of observed behaviors
Time of day they occurred
Description of the situation in which they occurred
Duration of the episode
Behavior following the episode

Children who are on anticonvulsant medication should be observed for possible seizure "break-through." Break-through may indicate low medication blood levels, noncompliance or poorly scheduled medication administrations, or a need for reevaluation for possible changes in drug dosages or consideration of another anticonvulsant drug.

The educator who suspects problems should be persistent in documenting and reporting his or her observations, even if the physician's tests (medication blood levels, EEG, etc.) seem to rule out seizure activity.

Toxic Effects of Antiseizure Drugs

Because all anticonvulsant drugs can be toxic, the educator should also be alert for symptoms of toxicity:

Confusion
Reduced attention
Changes in activity levels (higher or lower)
Changes in gait (staggering)
Bumping into objects or falling
Reduction or increases in verbal output
Reduction of social communication
Postural changes (slouching or leaning)
Changes in facial animation (limited affect)

Suspected toxicity should be immediately brought to the attention of the school nurse, the child's physician, and parents.

Medical Emergencies
When to Call 911

Because unrelenting seizures (status epilepticus) constitutes a medical emergency, an emergency protocol should be established in the event that the seizure episode does not abate within a reasonable period of time. This should be determined by the child's physician), but certainly a grand mal seizure which continues for more than one or two minutes would warrant medical attention. Medical attention should also be sought if grand mal episodes occur in succession, or if the child does not regain consciousness or cannot be roused soon after the seizure appears to abate.

Any frank convulsant activity should be reported to the child's parents and to the school nurse as soon as possible.

Teaching Implications

General educational considerations are not necessarily limited to issues of academic achievement. Children who have epilepsy reflect school-related learning problems which are probably manifestations of a complex interaction among organic/biological, medication, and social/emotional factors. **Fear** has been identified as a significant cause for difficulties with adjustment, both at home and in the community. Mittan (in Whitman & Hermann, 1986) has found that "fears of death and brain damage are common and multiple..." Common fears include dread of seizures, fear of being alone when a seizure occurs, fear of insanity, fear of becoming addicted to or poisoned by antiseizure medications, and fears of medical procedures. Additional fears include worry about being able to have children, fears of having a seizure in the presence of peers, and fears of physical activity or stress which may bring on a seizure.

Suggestions for treatment of seizure-related fears include the following:

1. Permitting the child to be aware of his or her fears. Providing assurances that fear is natural under the circumstances. Letting the child know that fears are common. A group support effort is an effective means of expressing and exploring fears (check community resources).

2. An honest, fact-based account of risks. Review means of reducing risks (medication compliance, rest, nutrition, exercise, stress reduction).

3. Provide examples of how fears affect day-to-day life, including school performance. Maladaptive behaviors should be recognized and explained as natural coping responses--signs not of personal inadequacy, but of inadequate training. The notion that coping with epilepsy is a learned skill should be emphasized.

4. Provide positive examples of ways to cope: get the best medical treatment possible; understand epilepsy; promote relaxation training, physical exercise, good nutrition, and avoidance of substance abuse; provide practical strategies to increase safety when away from home.

5. Stress the fact that fears cannot be neglected--explain that fear is insidious by nature and can become more disabling than the seizure disorder itself.

Additional information needs include:

The need to know what epilepsy is
To know what is happening to them
To understand what might happen
To know how to manage epilepsy and its impact on the child's life

Children with epilepsy need others to:

Listen to their questions
Understand their fears
To be supportive in making necessary adaptations
To learn about epilepsy and to share information
To allow them to be a co-participant in their education
To provide detailed and personally relevant judgments, opinions, support, and empathy

Subtle learning problems which often attend epilepsy may be approached by (1) reinforcing and pointing out successes following effort, (2) by pointing out failures following lack of effort, and (3) by providing highly structured instruction with specific directions. For example, missed spelling words may be identified and the child told:

"For each word you missed, trace the word with your finger. Write it three times on your paper. Say the word and the letters to yourself in a whisper each time you write it."

Directive approaches may be used effectively:

"No, the correct answer is England."
"This answer does not fit the sentence meaning; a better guess would be..."

Late Onset Post Traumatic Epilepsy

The child who develops late onset seizures (epilepsy) after traumatic brain injury presents particular challenges to teaching. Such a child may demonstrate severe impairments in learning new material resulting from reduced processing capacity and attentional deficits. In addition, newly learned material is fragile and may be fragmented or disrupted so severely by the abnormal electrochemical events of a seizure episode that critical portions of information become lost or irretrievable, even with aggressive probing or cuing. This same effect may attend subclinical electrophysiological events. The latter, of course, would not be evident, even to the most observant teacher.

Learning may be enhanced by reducing task complexity (teaching one dimension or one step of a task at a time). Frequent review of information which has already been presented would be beneficial. This might be accomplished by demonstrating the application of previously presented principles to different problems or situations, as well as by brief reminders about previous lessons before the introduction of new applications:

> "You remember that yesterday we learned that some mammals move to warmer areas during the winter. Well, many birds also migrate to warmer parts of the world. Bird migration begins in late summer or early fall, just as it does for reindeer and elk...."

New information may be preceded by review of earlier lessons:

> "Animals like birds and elk migrate to warmer parts of the world in late summer or early fall. Some hibernate, like bears and badgers. But many animals prepare for winter in other ways. They store food and grow heavier coats. They also may change color to blend with the colors of the winter season...."

Speech pathologist (Communication Disorders Specialist), Special Education Teacher, and Occupational Therapist consultants can provide the mainstream classroom teacher with activities and exercises which will enhance learning through multi-modality approaches (ie, pairing verbal with visual information, providing simplified verbal scripts for multi-step procedures, adapting memory books to include new subject content, etc.).

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